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# Impact of agricultural intensification on poverty alleviation among rural farm households in Imo state Nigeria

O.R. Iheke *, F.A. Arikaibe

*Department of Agricultural Economics Michael Okpara University of Agriculture, Umudike, P. M. B. 7267, Umuahia, Abia State, Nigeria*

## Abstract

This study was on the impact of agricultural intensification on poverty alleviation among rural farm households in Imo State Nigeria. Multi-stage random sampling and purposive sampling technique was used in choosing the samples used for the study. Data collections were by the use of structured questionnaire and interview schedules and data analysis involved the computation per capital household food expenditure and mean per capita household expenditure so as to draw the poverty line and hence derive the poverty status of the respondents, regression analysis as well as computation of the Chow's statistic. The results of data analysis revealed that poverty is more pronounced with the farm households that are not practicing agricultural intensification. The significant factors influencing the poverty level of the farmers practicing agricultural intensification were sex of household head, years of formal education, assets endowment, and income; while for the farmers not practicing intensification, household size, years of formal education, assets endowment, and income were the significant factors influencing their poverty level. For the two households, age, years of formal education, assets endowment, and income were the significant factors influencing their poverty level. Education, income and the dummy variable indicating intensification status were the significant factors influencing their poverty level for the entire household with a dummy introduced. The Chow's test revealed that agricultual intensification has a positive and significant impact on poverty reduction. Therefore, creation of awareness and persuading rural farming households to practice more of intensified agriculture would lead increase in productivity and income with a multiplier effect on poverty reduction.

***Keywords:*** Intensification, Poverty, Alleviation

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* Corresponding author. *E-mail address:* raphakwas@yahoo.com, iheke.onwuchekwa@mouau.edu.ng

## 1. Introduction

There are over two hundred thousand people living in extreme poverty today. They are said to live on less than one US dollar per day (World Bank, 2003). Poverty is a global phenomenon which threatens the survival of mankind (Ukpong, 1999). Majority of the poor people live in the rural area, where a large proportion of the people are engaged in one form of farming or another. Hence, Haggblade (2004) noted that significant poverty reduction will not be possible without rapid agricultural growth.

Nigeria is one of the poorest nations despite its enormous resources. According to NBS (2011), in terms of absolute poverty (defined in terms of the percentage of Nigerians with the minimal requirements necessary to afford minimal standards of food, clothing, healthcare and shelter), 54.7% of Nigerians were living in poverty in 2004 but this increased to 60.9% (or 99,284,512 Nigerians) in 2010 and Nigeria's relative poverty measurement (defined by reference to the living standards of majority in a given society)in 2004 stood at 54.4%, but increased to 69% (or 112,518,507 Nigerians) in 2010 also, the report indicated that 51.6% of Nigerians were living below US$1 per day in 2004, but this increased to 61.2% in 2010 and 75.5% of Nigerians considered themselves to be poor in 2004, and this increased to 93.9% in 2010. The Human Development Report (2010) ranked Nigeria as 142 out of 169 countries in terms of poverty.

Wide spread hunger and malnutrition along with low and stagnating productivity in agriculture tend to be at the top of the list of food and agricultural concerns in developing countries. Food crisis has been the major problem of the rural households (Mohammed et al., 2009).

Aniedu (2007) noted that most of the essential farm inputs are rather not readily available or their cost is beyond the reach of most farmers. He equally observed other problems to include; lack of access to credit facilities, funding of research and inadequate storage facilities. The premise is that the level of technology prevailing in a given society reflects its capacity to optimize the use of natural and human resource in production (Nwaru et al., 2008). This low state of technology has been the problem of agriculture and technical progress in the state. In order to reduce this problem, agricultural intensification becomes a veritable option which is the more efficient use of production inputs, increased productivity which comes from the use of improved varieties and breeds more, efficient use of labour and better farm management (Waddell, 1972; Pingali and Binswanger, 1987; Dixon et al., 2001; Nwaru et al., 2008). Agricultural intensification is therefore entail increased use of inputs or use of better quality inputs due to reduced fallow period in area of high population density where increased agricultural output can no longer come about through extension of land under cultivation.

Barlaug (2007) posits that per hectare increase in agricultural productivity will lead to a reduced demand for crop land, potentially sparing these lands for other uses, observing that cultural land areas have increased more slowly than might be expected given increase in population and changes in consumption patterns. Intensified production could reduce the global extent of croplands by 230million hectares.

Turner et al. (1993) in their study on population growth and agricultural intensification supported the induced intensification model. In this case, levels of cropping frequency has been achieved primarily by major increase in labour (amount per hectare) and by modest increase in capital inputs (monetary

investment). The idea that growing population causes environmental degradation has become conventional knowledge among researchers and policy makers. Iheke (2006) noted that growth in population combined with rapid urbanization has fuelled an increased demand for agricultural goods that regional production is increasingly failing to meet. The gravity of this problem for many developing countries becomes pertinent since the agricultural sector has been described as the engine room for the sustainable growth and development of developing economies (Olagunju, 2005; Malik, 1998). The problems associating agricultural intensification with increased frequency of cultivation has been highlighted into two studies of Kabala District of Uganda by Grisley et al. (1994) and Lindblade (1996). They noted that environmentally, favourable land use changes showed that increasing population was not associated with falling fallow. Edeoghon et al. (2008) suggest that population pressure leads to intensification through measures that did not include reduced fallow because farmers could not afford the cost involved in reducing fallow and so he intensified through increased inter-cropping.

Given that agricultural intensification leads to more efficient use of production inputs thereby increasing productivity, it has become imperative and indeed pertinent to examine its impact on poverty alleviation.

## 2. Methodology

The study was carried out in Imo State, Nigeria. The state is located in the South Eastern Zone of Nigeria (within the rainforest zone) and it falls within 4˚45' and 5˚61' of the equator and longitude 86˚5' and 72˚5' east of the Greenwich Meridian. The State occupies a total land area of 5,100 square kilometers lying between lower River Niger and upper Imo River from where it drew its name. The state has a projected population of 3934899 persons with a population density of 711.6 per square kilometer (NPC, 2006). Farming is the major occupation of the rural communities, with mixed farming as the predominant type of farming system in the area.

Multi-stage random sampling and purposive sampling technique was used in choosing the sample. In the first stage, two Local Government Areas (LGAs) were selected randomly from each of the three Agricultural Zones (Owerri, Orlu and Okigwe) of the State. From each of the LGAs, two communities were randomly selected and two villages were randomly selected from each community. In each village, five farmers were randomly. Thus, a total one hundred and twenty (120) respondents were used for the study. These farmers were disaggregated based on their intensification status to yield seventy seven farmers practicing intensified farming and forty three farmers not under agricultural intensification. Data collections were by the use of structured questionnaire and interview schedules.

The poverty status of the farmer was analyzed using Per Capital Household Food Expenditure (PCHFE).

$$\text{Per capital house food expenditure} = \frac{\text{Total household monthly expenditure}}{\text{Household size}} \quad (1)$$

The classification of household poverty status was based on Mean Per Capita Household Expenditure (MCHE).

$$\text{MCHE} = \frac{\text{Total per capita household expenditure}}{\text{Total number of household}} \quad (2)$$

The poverty line is then drawn from the mean per capita household total expenditure, to get two mutually exclusive classes and the classification of the rural dwellers. This was done as follows;

1. Rural household whose PCTHE is equal to or greater than 2/3 mean of PCTHE are considered non poor.
2. Rural household whose PCTHE is less than 2/3 mean PCTHE. There farmers are considered poor.
3. A core poor (extreme poverty) was defined as 1/3 of the mean per capita total household expenditure. Rural dwellers with per capita total house hold expenditure less than this would be considered extremely poor.
4. Rural household whose expenditure falls between core poor and below 2/3 PCTHE are considered moderately poor.

The impact of agricultural intensification on poverty status of the farmers was analyzed using Ordinary Least Square (OLS) methods and Chow's test. The model is stated implicitly as follows:

$$\text{Log PCE}i = f(X_{1i}, X_{2i}, X_{3i}, X_{4i}, X_{5i}, X_{6i}) \quad (3)$$

$(i = 1,2)$

$$\text{Log PCE} = f(X_1, X_2, X_3, X_4, X_5, X_6, D) \quad (4)$$

where: Log PCE = log of per capita household food expenditure per adult equivalent (AE), derived as:

$AE = 1 + 0.7\ (n_1\text{-}1) + 0.5n_2$ (11)

$n_1$ = number of adults aged 15 years and above

$n_2$ = number of children aged less than 15 years

$X_1$= sex (gender)

$X_2$= age (years)

$X_3$= household size (number of people living with the respondents)

$X_4$= total land holding (hectare)

$X_5$= income (naira)

$X_6$= educational level (years)

D= dummy (1= farmers under continuous cropping or intensified production system and 0= farmers under fallow periods of 5years and above or non-intensified production system).

Two regression analysis for the intensified production and non-intensified production system was carried our separately (equation 4) and then pooled for another regression (equation 5) with the dummy variable (1) representing the intensification status of the farmers were estimated.

Chows test was used to test if there is structured shift in poverty function between the groups of farmers. This is stated as follows:

i. Test for poverty effect

$$F^* = \frac{[\Sigma e^2_3 - (\Sigma e^2_1 + \Sigma e^2_2)] / [k_3 - k_1 - k_2]}{(\Sigma e^2_1 + \Sigma e^2_2) / (k_1 + k_2)} \quad (5)$$

where $\Sigma^2 e_i$ and $K_1$ are the error sum of square and degree of freedom respectively for the intensified system, $\Sigma^2 e_2$ and $K_2$ are the error sum of square and the degree of freedom for non-intensified system and $K_3$ are for the pooled data.

ii. Test for homogeneity of slopes, the f- statistics is calculated as follows:

$$F^* = \frac{[\Sigma e^2_4 - (\Sigma e^2_1 + \Sigma e^2_2)] / [k_4 - k_1 - k_2]}{(\Sigma e^2_1 + \Sigma e^2_2) / (k_1 + k_2)} \quad (6)$$

where $\Sigma^2 e_4$ and $K_4$ are the error sum of square and the degree of freedom for the pooled data with a dummy variable which has a value of one unity for intensified system and zero for non-intensified system.

iii. Test for difference in intercepts, the F statistics is calculated as follows:

$$F^* = \frac{[\Sigma e^2_3 - \Sigma e^2_4)] / [k_3 - k_4]}{\Sigma e^2_4 / k_4} \quad (7)$$

If the calculated F exceeds the tabulated F value, then the intercepts are assumed to be different between the intensified and non-intensified poverty functions.

## 3. Results and discussion

### 3.1. Poverty status of intensified and non-intensified farmers

The poverty status of the respondents were derived and presented in Table 1. It revealed that 53.25 percent of the intensified farmers were non poor as against 34.88 percent of the farmers not practicing agricultural intensification. On the other hand, 29.87 percent of the farmers under intensification practice

were poor while 44.17 percent of their counterparts were poor. About 17 percent and 21 percent of the intensified and non-intensified farmers were under extreme poverty. This result shows that poverty is more pronounced with the farm households that are not practicing agricultural intensification.

Table 1. Percentage distribution of respondents according to their poverty status

| | Intensified Farmers | | Non-Intensified Farmers | |
|---|---|---|---|---|
| Poverty status | Frequency | Percentage | Frequency | Percentage |
| Non-poor | 41 | 53.25 | 15 | 34.88 |
| Poor | 23 | 29.87 | 19 | 44.17 |
| Extremely poor | 13 | 16.88 | 9 | 20.93 |
| Total | 77 | 100 | 43 | 100 |

*Source: Field survey, 2011*

Investment in agriculture and rural development through the provision of high quality inputs/improved varieties of crops or breeds of livestock and rural infrastructure is therefore key to poverty reduction in rural agrarian economies. Agricultural intensification is therefore, a veritable option for rising out of poverty. These include land intensification and management aimed at addressing the simultaneous aspect of production and conservation (Obinna, 2006), more efficient soil production inputs and improved varieties and breeds which increases productivity (Dixon et al., 2001), more efficient use of water, and soil fertility management. These will lead to increased agricultural productivity with a concomitant increase in income and reduction in poverty.

## 3.2. Determinants of poverty for the households

The regression estimates of the determinants of poverty for the intensified, non-intensified, pooled data and pooled data with dummy representing intensification status is presented in Table 2. The coefficients of multiple determinations ($R^2$) were 0.5214, 0.4247, 0.6222 and 0.5232 for the intensified, non-intensified, pooled data pooled data with dummy signifying the intensification status respectively. These imply that 52.14 percent, 42.47 percent, 62.22 percent and 52.32 percent of the variations in poverty status for the intensified, non-intensified, pooled data and pooled data with dummy respectively were explained by the variables in the model. The F-ratios were all significant at 1 percent indicating the goodness-of-fit of the models.

The coefficient of sex for intensified household had a positive relationship with poverty status and was significant at 5 percent probability level. This implies that the male headed households are less poor or have better livelihoods than their female counterparts. This result is consistent with the findings of UNDP (2004) and IFAD (1992). UNDP (2004) noted that 70 percent of the world's poorest people are women.

Table 2. Determinants of poverty for intensified and non-intensified

| Variable | Intensified | Non-intensified | Pooled | Pooled with dummy |
|---|---|---|---|---|
| Intercept | 8.7147 | 9.969 | 9.242 | 9.295 |
| | (9.60)*** | (7.61)*** | (12.97)*** | (12.76)*** |
| Sex | 0.4808 | -0.2647 | -0.033 | -0.029 |
| | (2.05)** | (-0.98) | (-0.19) | (-0.16) |
| Age | -0.009 | 0.002 | -0.027 | -0.007 |
| | (-0.78) | -0.13 | (-2.83)*** | -0.69 |
| Household size | 0.05 | 0.034 | 0.031 | 0.033 |
| | -0.8 | -0.25 | -0.58 | -0.61 |
| Education | 0.349 | 0.0999 | 0.232 | 0.027 |
| | (2.99)*** | (2.05)** | (2.12)** | (2.48)** |
| Assets | 0.1 | 0.318 | 0.058 | 0.005 |
| | (3.13)*** | (2.77)*** | (1.97)* | -0.17 |
| Income | 3.04E+06 | 3.55E+06 | 2.99E+06 | 3.00E+06 |
| | (4.15)*** | (3.69)*** | (5.33)*** | (5.32)*** |
| Dummy | | | | 1.07 |
| | | | | (5.72)*** |
| $R^2$ | 0.5214 | 0.4247 | 0.6222 | 0.5232 |
| $R^{-2}$ | 0.4146 | 0.3121 | 0.5809 | 0.4746 |
| f-ratio | 3.32*** | 2.88** | 5.38*** | 4.60*** |

*NB: *** = significant at 1 percent, ** = significant at 5 percent, * = significant at 10 percent Source: survey data 2011*

*Figures in parenthesis are the t-ratios*

The coefficient of education was significant and positive for all the defined groups. This implies that poverty incidence is influenced by the educational qualification of the household heads. Similar finding was reported by FOS (1999) that people with low level of education tends to have higher incidence of poverty. This means that the extent of poverty decrease with increase in the educational qualification of the household heads.

The coefficients of asset holding and income had a positive and significant relationship with poverty for both intensified and non-intensified households respectively and for the pooled data. This implies that as the household assets and income increase, the rise out of poverty increases too. Thus, changes in assets ownership and income level of the entire farming households will influence their levels of poverty. The extent of poverty is more in household without assets than assets owing once. This could be that households who own assets may commercialize them during periods of hardship to generate additional income and it could also serve as collateral for loans from commercial banks and thereby increase the investment capacity of the farming households.

Age was negatively related to the poverty status of the entire farming household at 1 percent level of probability. This show that as age increases the farmers under study becomes poorer. According to Nwaru et

al. (2011), the decrease in the risk bearing ability and innovativeness of the farmer, his mental capacity to cope with the daily challenges and demand of farm production activities and his ability to do manual work decreases with age.

The dummy variable representing the intensification status was significant at 1 percent and positively related to poverty status of the farmers. This indicates that intensified farmers are more productive or non-poor than the non-intensified farmers and this may have resulted from the gains from intensification which led to increased productivity.

## 3.3. Tests for structural shift in poverty function and differences in poverty status

The results of the statistical tests for structural shift in poverty function and differences in poverty status were presented in Table 3. The calculated chow's F statistic for poverty effect was significant at 1%. The result confirms that there is significant difference between the poverty functions of the intensified and non-intensified groups of farmers. In other words, the intensified farmers are associated with structural modifications of their poverty, implying that the poverty functions of the households differ.

Table 3. Test for differences in poverty status

| **Nature of analysis** | **Sum of square** | **Degree of Freedom** | **Calculated F** |
|---|---|---|---|
| **Test for poverty effect** | | | |
| Intensified | 16.926 | 70 | |
| Non- Intensified | 12.629 | 36 | |
| Pooled data | 25.637 | 113 | 76.763*** |
| **Test for homogeneity of slope** | | | |
| Intensified | 16.926 | 70 | |
| Non- Intensified | 12.629 | 36 | |
| Pooled data | 25.748 | 112 | 74.616*** |
| **Test for difference in intercept** | | | |
| pooled data | 25.637 | 113 | 23.774*** |
| Pooled data with dummy | 21.148 | 112 | |

*Source: survey data 2011*

The result of the test for homogeneity of slopes in the poverty functions of the intensified and non-intensified groups of farmers show that the calculated Chow's F statistic is statistically significant at 1%. The result confirms heterogeneity of slopes. The calculated chow's F statistic for the test for differences in intercept is significant at 1%. This result confirmed heterogeneity of intercepts for the intensified and non-intensified groups of farmers. This confirms the result of the pooled data with dummy variable representing household type which revealed that intensified farmers are more productive or non-poor than the non-intensified farmers and this may have resulted from the gains from intensification which led to increased productivity.

## 4. Conclusion

It could be concluded from this study that agricultural intensification provided farmers with higher yield per hectare and growth in their gross income. It is a formidable step towards reducing poverty and hunger in developing countries, especially with rapid urbanization and population growth rates. This is based on the fact that agricultual intensification has a positive and significant impact on poverty reduction. Therefore, creation of awareness and persuading rural farming households to practice more of intensified agriculture would lead to increase in productivity and income with a multiplier effect on poverty reduction.

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